Please replace paragraph **[0030]**, with the following paragraph **[0030]**:

**[0030]** The planarizing process and composition that can used to polish a substrate disposed in chemical mechanical polishing process equipment, such as the MIRRA® polishing system, the MIRRA® MESA™ polishing system, and the REFLEXION™ polishing system, all of which are available from Applied Materials, Inc., The MIRRA® polishing system is further described in U.S. Patent No. 5,738,574, entitled, "Continuous Processing System for Chemical Mechanical Polishing," the entirety of which is incorporated herein by reference to the extent not inconsistent with the invention.

A1

Please replace paragraph **[0031]**, with the following paragraph **[0031]**:

**[0031]** Although, the processes and compositions described herein are illustrated utilizing a three platen system, such as the MIRRA® polishing system, any system enabling chemical mechanical polishing using the composition or processes described herein can be used to advantage. Examples of other suitable apparatus include orbital polishing systems, such as the Obsidian 8200C System available from Applied Materials, Inc., or a linear polishing system, using a sliding or circulating polishing belt or similar device. An example of a linear polishing system is more fully described in co-pending U.S. Patent Application Serial No. 09/244,456, filed on February 4, 1999, now U.S. Patent Serial No. 6,244,935, issued on June 12, 2001, and incorporated herein by reference to the extent not inconsistent with the invention.

Please replace paragraph **[0038]**, with the following paragraph **[0038]**:

A2

**[0038]** A soft polishing material is broadly described herein as a polishing material having a polishing surface of a hardness of less than about 50 on the Shore D Hardness scale for polymeric materials as described and measured by the American Society for Testing and Materials (ASTM), headquartered in Philadelphia, Pennsylvania. The soft polishing pad may be composed of a napped poromeric synthetic material, such as a uniformly compressible material including a polymeric material, *i.e.*, plastic,



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and/or foam, felt, rubber, or a combination thereof. An example of a soft polishing material is polyurethane impregnated with felt. An example of a soft polishing pad is the Politex or Suba series, *i.e.*, Suba IV, of polishing pads available from Rodel, Inc. (Politex and Suba are tradenames of Rodel Inc.).

A2

Please replace paragraph **[0041]**, with the following paragraph **[0041]**:

**[0041]** A rotatable linear platen may be used for the second polishing station 125b. An example of a linear polishing system, and an example of a polishing system having a rotatable polishing pad and a rotatable linear platen, is more fully described in co-pending U.S. Patent Application Serial No. 09/244,456, filed on February 4, 1999, now U.S. Patent Serial No. 6,244,935, issued on June 12, 2001, and incorporated herein by reference to the extent not inconsistent with the invention. Alternatively, a stationary platen or a rotatable or linear platen having a stationary article may be used for the first, second, or third, polishing stations 125a, 125b, and 125c.

A3

Please replace paragraph **[0047]**, with the following paragraph **[0047]**:

**[0047]** Figure 3 depicts a sectional view of the carrier head 180. The carrier head 180 generally includes a carrier plate 202, a cover 204, and a retaining ring 206. The carrier plate 202, which in one embodiment may comprise an inflatable bladder or membrane, generally presses the substrate 110 against the polishing and plating stations 100a, 100b, and 100c. The retaining ring 206 generally circumscribes the carrier plate 202 and prevents the substrate 110 from moving laterally out from under the carrier head 180 during processing. The retaining ring 206 may includes one or more grooves 222 disposed in a lower surface 224 of the retaining ring 206 as shown in Figure 4. The grooves 222 generally have a radial orientation. In one embodiment, the ring 206 contains at least three grooves. However, it is believed that grooves in the retaining ring 206 has corners or edges which may damage low k dielectric films and contribute to frictional forces that increase film delamination; and that a grooveless retaining ring is used when polishing substrates with the processes described herein.

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Please replace paragraph **[0048]**, with the following paragraph **[0048]**:

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**[00~~47~~]** Returning to Figure 3, the carrier plate 202 and retaining ring 206 are generally movable relative to one another in an axial direction. A relative distance 214 between the carrier plate's bottom and the retaining ring 206 may be controlled thus setting the relative distance that the substrate 110 extends beyond the retaining ring 206, or the amount of pressure the retaining ring 206 exerts upon the polishing or processing table 100a, 100b, and 100c.

Please replace paragraph **[0049]**, with the following paragraph **[0049]**:

A4

**[0049]** In the embodiment depicted in the enlargement of Figure 3, the retaining ring 206 is movably coupled to the carrier head 180 by a flexure 208. The flexure 208, which may be a flexible metal sheet or polymer, is disposed between the retaining ring 206 and the carrier plate 202 to allow axial movement therebetween. A piston 210 disposed in the cover 204 is coupled to the retaining ring 206. Fluid is supplied to (or removed from) the piston 210 and urges the retaining ring 206 in the axial direction, thereby defining the distance 214. Examples of other embodiments of polishing heads 130 that have a retaining ring and a carrier plate positional relative to each other are described in United States Patent No. 6,024,630, issued February 25, 2000 to *Shendon, et al.*; United States Patent Application No. 08/861,260, filed May 21, 1997 by *Zuniga*, now U.S. Patent Serial No. 6,183,354, issued on February 6, 2001; and United States Patent Application No. 09/258,042, filed February 25, 1999 by *Somer, et al.*, now U.S. Patent Serial No. 6,276,998, issued on August 21, 2001, all of which are hereby incorporated by reference in their ~~entireties.~~

Please replace paragraph **[0060]**, with the following paragraph **[0060]**:

A5

**[0060]** In one aspect of the invention, reduced film defects, reduced residual material, and reduced delamination may be achieved by having a carrier head rotational speed



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greater than a platen rotational speed by a ratio of carrier head rotational speed to platen rotational speed of greater than about 1:1, such as a ratio of carrier head rotational speed to platen rotational speed between about 2:1 and about 12:1, to remove conductive material. A ratio of carrier head rotational speed to platen rotational speed of between about 10:1 and about 12:1 has been used to effectively remove conductive material with minimal or reduced film delamination.

A5

Please replace paragraph **[0068]**, with the following paragraph **[0068]**:

**[0068]** The dielectric layer can comprise any of various dielectric materials known or unknown that may be employed in the manufacture of semiconductor devices. For example, dielectric materials, such as silicon dioxide, phosphorus-doped silicon glass (PSG), boron-phosphorus-doped silicon glass (BPSG), and carbon-doped silicon dioxide, can be employed. The dielectric layer may also include low dielectric constant (low k) materials, including fluoro-silicon glass (FSG), polymers, such as polymides, silicon carbide, such as BLOK™ dielectric materials, available from Applied Materials, Inc. of Santa Clara, California, and carbon-containing silicon oxides, such as BLACK DIAMOND™ dielectric materials, available from Applied Materials, Inc. of Santa Clara, California. The openings are formed in interlayer dielectrics by conventional photolithographic and etching techniques. The invention also contemplates the use of dielectric materials, known or unknown, that may be used as dielectric layers in semiconductor fabrication.

A6

Please replace paragraph **[0073]**, with the following paragraph **[0073]**:

**[0073]** A further description of a two-pressure polishing process is in U.S. Patent Application Serial No. 09/469,709, filed on December 21, 1999, and U.S. Patent Application Serial No. 09/741,538, filed on December 19, 2000, now published as 2001/0004538 on June 21, 2001, both of which are incorporated herein by reference to the extent not inconsistent with the disclosure or claimed aspects herein.

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Please replace paragraph **[0096]**, with the following paragraph **[0096]**:

**[0096]** The substrate may then be transferred to the third polishing platen having the third polishing pad 100c for a buffing process at step 350. An example of a buffing process comprises positing the substrate on the third platen having a soft polishing pad, such as a Politex pad, delivering an cleaning composition, such as an ELECTRA CLEAN™ composition available from Applied Materials, of Santa Clara California, to the polishing pad and polishing at 63 rpm and a contact pressure of about 2 psi for 20 seconds, washing the substrate surface with deionized water for 10 seconds, and applying a polishing slurry, such as an ELECTRAPOLISH™ composition available from Applied Materials, of Santa Clara California, to the polishing pad and polishing at 63 rpm and a contact pressure of about 2 psi for 20 seconds.

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Please replace paragraph **[0097]**, with the following paragraph **[0097]**:

**[0097]** Optionally, a cleaning solution may be applied to each of the polishing pads during or subsequent each of the polishing process to remove particulate matter and spent reagents from the polishing process as well as help minimize metal residue deposition on the polishing pads and defects formed on a substrate surface. An example of a suitable cleaning solution is ELECTRA CLEAN™ composition commercially available from Applied Materials, Inc., of Santa Clara, California.

Please replace paragraph **[0102]**, with the following paragraph **[0102]**:

**[0102]** A series of substrates were polished according to the two-step polishing process described above in steps 300-350. A first experimental process was performed on a MIRRA® three platen polishing system using Cabot EPC-5001 composition on a IC-1010 polishing pad on platen 1, an ELECTRAPOLISH™ polishing composition from Applied Materials, Inc., of Santa Clara, California, on a IC-1010 on platen 2, and an ELECTRAPOLISH™ polishing composition on a Politex pad on platen 3.

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Please replace paragraph **[0103]**, with the following paragraph **[0103]**:

**[0103]** The substrates polished under the processing condition shown in Table 1 below comprise a substrate stack of silicon, a first BLACK DIAMOND™ low k dielectric film, a BLOK™ low k dielectric film, a second BLACK DIAMOND™ low k dielectric film, a dielectric anti-reflective coating (DARC), which a feature definition was formed in the dielectric layers and filled using a tantalum nitride barrier layer, and then a copper fill of the feature definition. An example substrate may contain a silicon surface, 1 μm thick BLACK DIAMOND™ dielectric layer, 500Å thick BLOK™ dielectric barrier layer/etch stop, 5000Å thick BLACK DIAMOND™ dielectric layer formed thereon. A feature definition was formed in the dielectric layers and filled with a 250 Å layer of tantalum nitride and 2000 Å of copper seed layer followed by 1 μm of electroplated copper. A series of substrates composed above was polished using the compositions and polishing pads described above by the processes parameters listed in Table 1 below:

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**Table 1: Experimental Processing Parameters**

| Wafer # | P1(1st) | Prr/ Pm | Peeling/ RR | Peeling | P1(2nd) | P2 | P3 |
|---|---|---|---|---|---|---|---|
| **W1 (Control)** | 3/93/3.4 for 40s | 1.1 | 2 | 2 | 2/43/2.3 | 3/103/3.4 | P3 Buffing |
| **W2 (Control)** | 3/93/3.4 for 40s | 1.1 | 2 | | 2/43/2.3 | 3/103/3.4 | P3 Buffing |
| **W3** | 3/93/6 for 40s | 2 | 1 | 1 | 2/43/4 | 3/103/6 | P3 Buffing |
| **W4** | 3/93/6 for 40s | 2 | 1 | | 2/43/4 | 3/103/6 | P3 Buffing |
| **W5** | 3/93/7.5 for 40s | 2.5 | 0 | 0.5 | 2/43/5 | 3/103/7.5 | P3 Buffing |
| **W6** | 3/93/7.5 for 40s | 2.5 | 1 | | 2/43/5 | 3/103/7.5 | P3 Buffing |
| **W7** | 3/93/9 for 40s | 3 | 0 | 0.5 | 2/43/6 | 3/103/9 | P3 Buffing |
| **W8** | 3/93/9 for 40s | 3 | 1 | | 2/43/6 | 3/103/9 | P3 Buffing |
| **W9** | 3/93/10.5 for 40s | 3.5 | 1 | 1 | 2/43/7 | 3/103/10.5 | P3 Buffing |
| **W10** | 3/93/10.5 for 40s | 3.5 | 1 | | 2/43/7 | 3/103/10.5 | P3 Buffing |
| **W11(Control)** | 2/43/2.3 for 120s | 1.1 | 2 | 2 | 2/43 | 3/103 | P3 Buffing |
| **W12(Control)** | 2/43/2.3 for 120s | 1.1 | 2 | | 2/43 | 3/103 | P3 Buffing |
| **W13** | 2/43/5 for 120s | 2.5 | 0 | 0.5 | 2/43/5 | 3/103/7.5 | P3 Buffing |
| **W14** | 2/43/5 for 120s | 2.5 | 1 | | 2/43/5 | 3/103/7.5 | P3 Buffing |

T,0311

Please replace paragraph **[0110]**, with the following paragraph **[0110]**:

A10

**[0110]** The process parameters of Table 2 are as follows. Split is the wafer number, RR is the retaining ring contact pressure in psi, Pl is the platen rotational speed in rpms, H is the carrier head rotational speed in rpms, and peeling is the degree of delamination with 0 being no observable peeling, 1 being almost no peeling, 2 being minor peeling of





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